Soil Biology and Biochemistry 124 (2018) 189–198

Contents lists available at ScienceDirect

Soil Biology and Biochemistry

journal homepage: www.elsevier.com/locate/soilbio

Review Paper

Are leaf litter and microbes team players? Interpreting home-field advantage decomposition dynamics

Julia E. Palozzi, Zoë Lindo*

The University of Western Ontario, Department of Biology, London, Ontario, N6A 5B7, Canada

ARTICLE INFO

Keywords:
Decomposition
Home-field advantage
Litter-environment feedbacks
Microbial community
Nutrient availability
Plant strategy

ABSTRACT

In the ecological literature, a 'home-field advantage' (HFA) describes the phenomenon where plant litters are broken down more quickly in their native versus a foreign environment due to a hypothesized specialised decomposer-litter relationship. Climate change is expected to spatially shift plant communities at an imbalanced rate compared to their decomposers, resulting in previously unexperienced above- and belowground pairings. Understanding decomposition dynamics has implications for global climate and carbon models, yet a clear predictive framework for the HFA has not been proposed. The ecological HFA concept is borrowed from the sports realm where extensive research has found a consistent, greater-than-random chance that teams in sports competitions win games played at their home venue because players are in better physical and psychological states. While research continues to show the sports HFA present in all types of sports independent of playing level or region, the ecological HFA has been shown inconsistently and cannot currently be generalised across scales and ecosystems. In this review, we map the ecological HFA onto a framework used to interpret the HFA in sports. First, we identify and outline the 'game' of decomposition, the 'teams' of decomposer organisms, how plants 'coach' this game, and also how ecological researchers are involved in their role as game 'officials'. Second, we place parallels between the game location factors established in the sports analogy and their ecological counterparts to reveal a greater mechanistic understanding of the ecological HFA. Here we explore microbial adaptation to abiotic environments, the role of historical resource inputs, and how degree of ecosystem contrast and definitional ambiguity affect the HFA. In doing so, we discuss how microbial functional breadth, plant strategy and temporal effects play into the HFA. Using the sports HFA framework provides a novel and promising approach to understanding the ecological HFA that has been lacking, and helps identify potential factors that may not traditionally have been considered. Our framework incorporates multiple theories and views the HFA as a 'team effort' involving multiple components.

1. Introduction

In the ecological literature, a 'home-field advantage' (HFA) describes the phenomenon where plant litters decompose more quickly in their native versus a foreign environment. The ecological HFA concept, in name at least, is borrowed from the sports analogy where there is a consistent finding that teams in sports competitions win more than 50% of the games played at home under a balanced home and away schedule (Courneya and Carron, 1992). Although there had been strong evidence for the HFA in sports since the phenomenon was first documented over 60 years ago (Roth, 1957; Rubin, 1958), disentangling the causal factors took many decades, with sports psychologists finally arriving at the explanation that players are in a better physical and psychological state while competing at home-venues (Schwartz and Barsky, 1977). In the early 1990s, a conceptual framework was proposed by Courneya and Carron (1992) to provide a systemic and comprehensive interpretation of the sports HFA across a multitude of different sports, and this facilitated an approach to investigating the mechanisms underlying the HFA. Courneya and Carron's framework has been heavily employed since (Carron et al., 2005; Legaz-Arrese et al., 2012), and studies have confirmed the role of coaches and officials, in addition to players, in generating a HFA (Boyko et al., 2007; Gayton et al., 2001; Pollard et al., 2017).

For the ecological HFA, the underlying explanation has been that decomposer communities are adapted to the plant litter in which they are most familiar (Ayres et al., 2009a), suggesting that decomposers become specialised for particular litters, leading to the prediction that plant litter decomposition is faster than expected in the vicinity of the plant where it originates (Veen et al., 2015a). However, consensus on whether an ecological HFA exists remains inconclusive, as the number

* Corresponding author.
E-mail address: zlindo@uwo.ca (Z. Lindo).

https://doi.org/10.1016/j.soilbio.2018.06.018
Received 10 January 2018; Received in revised form 17 June 2018; Accepted 18 June 2018
Available online 22 June 2018
0038-0717/ © 2018 Elsevier Ltd. All rights reserved.

of studies providing evidence for a HFA (e.g., Allison et al., 2013; Ayres et al., 2009b; Jacob et al., 2010; Palozzi and Lindo, 2017a; Vivanco and Austin, 2008) are nearly met in number by those that do not (e.g., Ayres et al., 2006; Bachega et al., 2016; Gieβelmann et al., 2011; Makkonen et al., 2012; Perez et al., 2013; Veen et al., 2015b). The presence or absence of an observed HFA has been attributed to variation in the main controls on decomposition, namely climate (Veen et al., 2015a), litter quality (Ayres et al., 2009a), or the decomposer community (Hunt et al., 1988), as well as to litter-site affinities (Austin et al., 2014), substrate-matrix interactions (Freschet et al., 2012) and phenology-substrate matching (Pearse et al., 2014). However, our understanding continues to fall short as we lack a unified framework for understanding the ecological HFA.

The ambiguity in the ecological HFA literature is in part due to an abstract definition for what constitutes a HFA. In sports, the HFA is measured by different levels of performance outcomes that contribute to the HFA phenomenon, but in ecology, clearly defined performance outcomes are lacking. The primary, secondary and tertiary performance outcomes in sports are measures of fundamental performance (e.g., free throw percentage), scoring necessary to win (e.g., points scored) and binary win or loss outcomes, respectively. In HFA studies, these could be paralleled to the fundamental level of decomposition (e.g., mass loss, or change in litter quality due to decomposition), whether HFA was observed or not, and the magnitude of the HFA, respectively. An innovative aspect of the original framework is the division of performance outcome measuring the HFA at these three different levels, which invokes the notion that HFA exists on a spectrum, including potential negative outcomes (a home-field *dis*advantage) (Veen et al., 2015a). Measuring performance outcome across these three levels allows for a clearer description of the HFA, and to identify factors common to experiments that detect HFA, versus those that do not. As such, while we propose a more predictive framework for the HFA, we also propose a more flexible definition for the HFA beyond specialised litter-decomposer relationships. We characterise the ecological HFA as *enhanced decomposition of plant litter in a native environment, arising from microbe energetic and stoichiometric requirements for growth and survival*. We avoid the idea of 'faster' decomposition dynamics recognizing that the process of decomposition involves more than mass loss (which can arise from purely abiotic factors such as leaching), and suggest that the ontogeny of detritus (*sensu* Moore et al., 2004) is an important aspect linking decomposition, the HFA, and the energetic and stoichiometric needs of both plant and microbial communities.

The importance of needing to understand the ecological HFA is implicit in understanding overall decomposition dynamics that have implications for global climate and carbon models. Climate change is expected to spatially shift plant communities at a rate that is disparate to shifts in local decomposers, resulting in previously unexperienced above- and belowground pairings, potentially decoupling the HFA (Bardgett et al., 2013). Climate change is also expected to directly alter microbe-microbe, as well as plant-microbe interactions (Classen et al., 2015), with additional implications for carbon and nutrient cycling, and plant productivity. While some studies have shown that microbial communities can accommodate a shift in plant community without disrupting carbon cycling (e.g., Haynes et al., 2015), other studies suggest that microbes are not as generalist (Strickland et al., 2009a) or resilient (Allison and Martiny, 2008; Martiny et al., 2017) as previously thought. Developing a mechanistic understanding of decomposition dynamics is needed (Yu et al., 2015) for reliable predictions of carbon flux and storage (Gholz et al., 2000) under climate change. The implications of ignoring or simplifying HFA dynamics could lead to misinformed soil carbon models and potential cascading consequences for land management, policy, and economic decisions (e.g., carbon credits).

The purpose of this paper is to present a conceptual and predictive framework for the ecological HFA by paralleling the successful framework by Courneya and Carron (1992) used to interpret HFA in sports (Fig. 1). First, we define the different contributing aspects of decomposition processes to the HFA and map these features directly onto Courneya and Carron's sports framework. We then present aspects of a 'home-game' location that might contribute to an ecological HFA (i.e. when a HFA might exist), discussing the effects of the soil environment (crowd) and historical contingencies (familiarity), as well as contrasting abiotic conditions (travel), and how a researcher's definition of the HFA and experimental design (rules) can influence the interpretation of the HFA. We then explore how critical states of the decomposer 'players' and their plant 'coaches' affect the HFA by drawing upon concepts of functional breadth and plant strategy, respectively. By using the sports HFA analogy, we identify factors not traditionally considered by ecologists, permitting a deeper understanding of the interactions governing plant litter decomposition, and possibly explaining inconsistent HFA results. Our goal is to develop a predictive framework for the HFA which would identify specific factors that contribute to the lack of consistency in the HFA.

2. From sports fields to old-fields: identifying participants and defining key terms

To set the stage for our framework, we begin by introducing key components and make direct translations between sports and ecological participants of the home-field advantage. We outline the 'game' of decomposition, key players on the 'teams' of decomposers, and how plants 'coach' the game 'officiated' by principal investigators.

2.1. The 'game' of decomposition

Unlike the sports HFA which has been documented for multiple sports, the ecological HFA is applied to a single activity: decomposition. Our framework is therefore centered around the 'game' of plant litter decomposition, where the goal of the decomposer 'competitors' is to gain resources to meet metabolic and stoichiometric needs through the process of breaking-down organic substrates into its subcomponents of relatively simple (e.g., starch, sugars, fats, hemicellulose) and complex compounds (e.g., aromatic polymers such as lignin and phenolics) (Berg, 2000). Generally, decomposition of organic substrates is regulated by three interacting factors: climate (moisture and temperature), quality of plant litter and the availability of supporting soil nutrients, and type and abundance of the decomposer community (Coûteaux et al., 1995; García-Palacios et al., 2016). Decomposition rates are typically related to temperature and moisture (Aerts, 1997), community composition (van der Heijden et al., 2008), and nutrient concentrations in plant and soil material (Berg, 2000; Jacob et al., 2010).

2.2. The 'teams' of decomposer organisms

The primary decomposers are teams of microbes with members of the entire soil food web (e.g., protists, nematodes and microarthropods) as supporting players. Just as sports teams are often structured with different lines of play (i.e., a unit of players that play together) that perform certain functional or strategic purposes (e.g., a skilled 'first' line-offense), trophic levels within a belowground food web form consecutive lines of energy and nutrient processing of organic matter substrates. Not all the supporting players contribute directly to the mass loss decomposition dynamics of the organic substrate, but play supporting or indirect roles for the star players: the microorganisms, namely bacteria and fungi.

The microbial community, as the first line of decomposition, uses cellular enzymes to degrade simple (labile) carbon sources, cellulose and eventually more structural (recalcitrant) compounds (e.g. lignocellulose) (Allison, 2012; van der Heijden et al., 2008). Bacteria and fungi form two distinct pathways or energy channels originating from resistant detritus through fungi, and labile detritus through bacteria (Coleman et al., 1983; Hunt et al., 1987). The bacteria channel supports

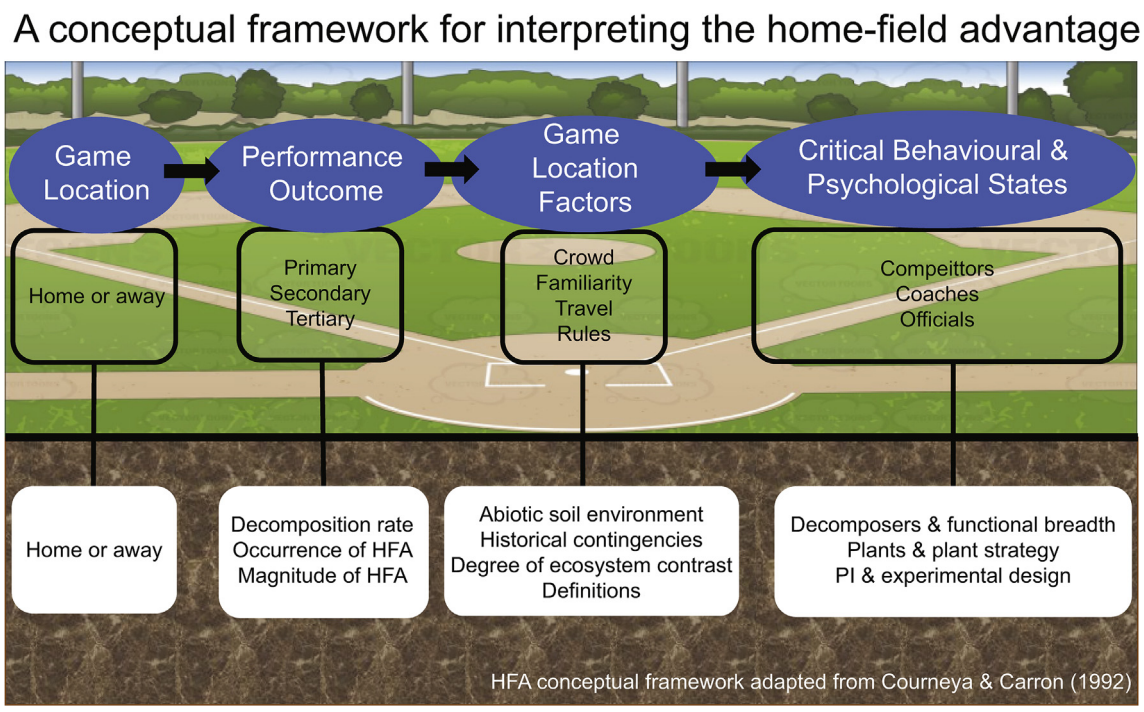

Fig. 1. A conceptual framework for interpreting the home-field advantage (HFA) of litter decomposition, modified from Courneya and Carron's (1992) original framework established in sports psychology to include factors that drive the HFA in decomposition.

smaller-bodied consumers such as protozoa and nematodes, with only a few arthropods, while the fungal energy channel largely consists of saprobic fungi, and larger-bodied and more diverse communities of microarthropods. Nutrients within each channel are processed at different rates (fast and slow, respectively) (Orwin et al., 2010) as bacteria degrade more nutrient rich substrates (i.e., low C:N) (Wallenstein et al., 2006), while fungi tend to degrade substrates with higher C:N, linked to their broader enzymatic capabilities relative to bacteria (Waring et al., 2013). As such, plant litter-decomposer interactions are more pronounced in poor-quality litters, suggesting that microbial identity is less important than microbial function (e.g., enzyme activity) (Fanin and Bertrand, 2016). Furthermore, traits among microbes that confer a competitive decomposition advantage such as longer hyphae and aggressive foraging strategies (Strickland et al., 2009b), can facilitate more effective foraging for nutrients of ectomycorrhizal fungi associated with plants in low-nutrient environment (van der Heijden et al., 2008).

Secondary (i.e., non-microbial) decomposers contribute up to 10% of C mineralisation and 30% of nutrient mineralisation during decomposition (Hättenschwiler et al., 2005), and comprise the remaining soil decomposer team. Microfauna (protozoa and nematodes) and mesofauna (springtails and mites) both act to regulate bacterial and fungal populations (Hättenschwiler et al., 2005; Geisen, 2016). Studies have confirmed a role of mesofauna in the HFA (St. John et al., 2011), but mainly when litter quality is low (Gergócs and Hufnagel, 2016; Milcu and Manning, 2011), suggesting that important consumer-microbe-resource interactions as well as microbe-microbe interactions (Gui et al., 2017; Waring et al., 2013) are important determinants of decomposition processes and may alter ecological HFA outcomes.

2.3. Plants as 'coaches' of decomposition

Plant-soil feedbacks are long recognized as drivers of plant productivity and decomposition rates through nutrient availability and leaf litter quality, respectively (Aerts and Chapin, 2000; Baxendale et al., 2014; Cornelissen et al., 1999; Dorrepaal et al., 2007; Palozzi and Lindo, 2017b). Plants therefore 'coach' the decomposition game by dictating how fast nutrients can be accessed by microbes directly through litter quality, and indirectly through litter-environment feedbacks. Physical and chemical plant traits that determine decomposability are significant drivers of decomposition (García-Palacios et al., 2015), are often the main control at small spatial scales (Pérez-Harguindeguy et al., 2000), and have been linked consistently to the HFA (Jewell et al., 2015; Milcu and Manning, 2011). Tensile strength and leaf thickness are physical traits affecting decomposition (Cornelissen et al., 1999), whereas ecostoichiometric concentrations of litter macronutrients (C, N, P, S), micronutrients (Ca, Mg), water soluble-compounds, and concentrations of complex compounds (e.g., lignin, condensed tannins) are important chemical traits (García-Palacios et al., 2015; Makkonen et al., 2012).

Plant litter can also influence decomposition rates indirectly through feedbacks that affect organisms or the soil environment (Chomel et al., 2015), physically (Bachega et al., 2016; Vivanco and Austin, 2008) or chemically (Palozzi and Lindo, 2017b). Carrillo et al. (2016) found plant litter stoichiometry to be important in driving functional groups of decomposer communities, while Lu et al. (2017) and Joly et al. (2017) found that litter quality controlled decomposition by local decomposers. Leaf litter quality is a dominant factor in explaining decomposition patterns (e.g., Aerts, 1997; Cornwell et al., 2008; Zhang et al., 2008) and increasingly hypothesized for explaining observed HFA (Ayres et al., 2009a; Chomel et al., 2015; Gergócs and Hufnagel, 2016; Li et al., 2017; Milcu and Manning, 2011), but not without considerations of the microbial and decomposer community. For instance, Sauvadet et al. (2017) found similar mass loss rates despite differential responses of microfauna and contrasting enzymatic activities of microbes, while Wickings et al. (2012) found that different end-game litter residues arose from similar initial litter chemistry due to different decomposer groups.

2.4. Ecological researchers as game 'officials'

The role of officiating bias in the sports HFA has become more pronounced in recent decades as it is well documented that officials award more penalties to visiting teams (Boyko et al., 2007; Pollard

et al., 2017), thus it is not surprising that the HFA is found to be consistently greater in subjectively-versus objectively-judged sports (e.g., diving vs soccer, respectively) (Legaz-Arrese et al., 2012). In our framework, we parallel principal investigators to officials because they dictate the way in which the data are collected, analysed and interpreted. For instance, in a meta-analysis of published data, Bradford et al. (2016) show that the role of climate in regulating decomposition processes may have been inflated due to experimental design and analysis, specifically for HFA studies that involve biome-level litter reciprocal transplants where the influence of decomposers may be masked by climate (Keiser and Bradford, 2017).

The HFA is typically tested through reciprocal transplants of litter (e.g., Palozzi and Lindo, 2017a; Veen et al., 2015b), soil inocula (e.g., Strickland et al., 2009a; b), or both (e.g., Allison et al., 2013; Ayres et al., 2009a). However, St. John et al. (2011) caution that different approaches might result in different outcomes of the HFA, due to the presence or absence of surrounding home litter (i.e., litter mixing effects). How litter decomposition is quantified and interpreted also affects our ability to generalise and compare results. While litter decomposition can be measured through total mass loss or microbial respiration (i.e., activity), limitations exist. First, many HFA studies using litterbags to measure decomposition rates examine mass loss of fresh (or fresh senesced) substrates over only one or two years, which reflects only short-term decomposition dynamics, and may not represent longer-term decomposition rates. In addition, accounting for leaching that occurs in mass loss transplants may not always be captured in laboratory-based microbial experiments (Del Giudice and Lindo, 2017). On that note, whether lab experiments can truthfully represent what happens in the field (Boynton et al., 2017) requires further testing. Using respiration rates can also be problematic as separating microbial respiration from root or faunal respiration is difficult (Berg and McClaugherty, 2014). How researchers measure and quantify an HFA is also variable in the literature, with mass loss rates having been analysed by two-way ANOVAs (Allison et al., 2013) or linear mixed models (Bachega et al., 2016). However, the HFA is increasingly quantified using equations from Ayres et al. (2009a), which were adapted from algorithms used to quantify the HFA in sports (Clarke and Norman, 1995), and account for pair-wise litter-site differences. In brief, this approach estimates an averaged sum of pairwise differences in litter species mass loss measurements between sites, but could also be applied to other aspects of the decomposition (e.g. carbon quality). Inferring a HFA when only dealing with raw data (e.g., mass loss) is difficult as it precludes this, and not surprisingly, studies analysing raw mass loss data (e.g., Makkonen et al., 2012), or respiration rates (Haynes et al., 2015) rather than using the HFA equations typically do not detect a HFA.

The role of experimental design and the appropriate statistical tests used in plant-soil interaction studies has been under recent tennis-match-like scientific debate. Based on data simulations, Reinhart and Rinella (2016) and Rinella and Reinhart (2017) assert that plant-soil studies fall victim to type I error when replicates (e.g., plant litter or inocula) from multiple sites are pooled versus kept separate. However, through a slightly modified simulation, Cahill et al. (2017) show how both soil handling methods (pooled versus individual) are in fact sensitive to type I and II error, and that increasing sample size would mitigate both. Cahill et al. (2017) also highlight the role of the research question in dictating soil handling methods, which is echoed by Gundale et al. (2017) in a terminal reply. In a HFA context, one might pool litter or soil (depending on the nature of the reciprocal transplant) from multiple plots within a site to test for inter-site HFA (e.g., site 1 versus 2), or keeping samples separate if testing for intra-site (e.g., microtopographic feature 1 versus 2) HFA.

3. Game location factors

A breakthrough in the sports HFA research was the identification of factors specific to the game location, versus a binary home-away designation that could contribute to a HFA, such as the crowd, venue familiarity, amount of travel, and upper-hand rules (Courneya and Carron, 1992). In our ecological analogy, these factors are paralleled to the following decomposition location factors: the abiotic soil environment, historical contingencies, contrast in ecosystem properties, and definitions of the HFA, respectively.

3.1. Crowd – abiotic soil environment

In sports, the crowd stands out as one of the most obvious differences between home and away venues. Aspects of spectator support (e.g., density, cheering) have been linked to the presence of a HFA in several sports (Balmer et al., 2003; Goumas, 2014). As sports teams have ongoing interactions with a crowd in their immediate environment, so do teams of decomposers with their soil abiotic environment, and confer benefits that might be associated with home soils. We parallel a sports team's partisan crowd to the abiotic soil environment of the home site. Physical (e.g., temperature, moisture, soil particles) and chemical (e.g., acidity, nutrients, metals) aspects of the soil environment that affect decomposers and thus litter decomposition can be quite different between native and transplanted sites. Although decomposer organisms have traditionally been considered as being functionally redundant, i.e. perform and respond similarly regardless of community composition or environment (Schimel and Schaeffer, 2012), there is an emerging perspective that belowground organisms (bacteria, fungi, mesofauna) respond differently to environmental change (Classen et al., 2015), can be locally adapted to abiotic properties (Gorter et al., 2016), and that litter decomposition is context-dependent (Midgley et al., 2015).

Temperature, soil moisture, and nutrient availabilities are main drivers of decomposition rates. Temperature exerts direct impacts to the physiological response of decomposers (Classen et al., 2015). Some microbes can thermally adapt (Bradford, 2013), yet others have found that warming can induce changes in enzymatic expression (Wang et al., 2014). As microbial activity is tightly linked to soil temperature (Bahn et al., 2010), which differs by biome, the HFA outcome might be influenced in cross-biome reciprocal transplants of soil inocula as microbes can experience a decreased carbon use efficiency when warmed (Allison et al., 2010; Frey et al., 2013). Similarly, bacterial and fungal components of the primary decomposers are differentially affected by drought (Allison et al., 2013; Sayer et al., 2017), and thus microbial adaptation to drought conditions may alter the HFA outcome. In terms of acidity, a link between pH and microbial communities has also been established (de Vries et al., 2012; Rousk et al., 2011), though the role in the HFA is relatively unexplored. Despite the recognized important of nutrients such as nitrogen for litter decomposition (Berg, 2000), studies involving N availability have revealed inconsistent effects on litter decomposition (Allison et al., 2013; Li et al., 2017) and context-dependent effects on microbial communities (Jiang et al., 2014). For instance, Jiang et al. (2014) found that N addition did not enhance decomposition uniformly (i.e., the most bioavailable substrate), but rather was dictated by whether fungal species were cellulolytic or lignolitic, and accordingly, cellulose-rich litter or lignin-rich needle decomposition was enhanced asymmetrically. The main consideration here is that there are inherent differences in soil environments that are not always considered, but could be contributing to a false-positive or false-negative HFA.

3.2. Familiarity – historical contingencies

In sports, familiarity with the home venue is shown to account for up to 24% of the home-field advantage (Pollard, 2002). Consistent across multiple sports, Pollard (2002) found the HFA during a first season at a new venue to be significantly lower than the HFA during a final season at an old venue, suggesting familiarity is a key aspect of the

HFA. Familiarity of athletes with their facilities can be paralleled to how decomposer organisms are 'familiar' with most prevalent plant litter; a function of past resource status also known as legacies or historical contingencies (*sensu* Strickland et al., 2009a) where it is thought that contemporary microbial communities are shaped by past resource inputs (i.e., litter) in addition to traditional contemporary factors. Consistent with this hypothesis, Keiser et al. (2011) found that initial functional differences of microbial communities were maintained across time, such that microbial communities performed decomposition more effectively when they had an (experimental) history (e.g., 100 days) of the environment. Strickland et al. (2009a) suggests that the ability of a microbial community to decompose plant litter is contingent upon the chemical complexity of past resource inputs, with this historical effect being more important for increasingly complex litter substrates.

Support for the assertion of HFA being stronger for more recalcitrant litter because it requires a specialised decomposer is invoked in a number of studies (e.g., Ayres et al., 2009a; Gergócs and Hufnagel, 2016; Milcu and Manning, 2011), and specialised decomposer communities have been thought to underlie the HFA since its conception (Hunt et al., 1988). As such, consensus has grown around the role of plant litter legacies as a selective force for specialised decomposer communities (García-Palacios et al., 2016), and has been proposed a potential mechanism for generating a HFA (Austin et al., 2014).

In addition to historical contingencies of plant litter, contemporary microbial function (response and effect) can be influenced by past moisture conditions (Strickland et al., 2015). To explore whether microbial community response to current conditions can be mediated by past moisture regimes, Evans and Wallenstein (2012) subjected soil microbial communities that experienced varying long-term rainfall manipulations (e.g., high or low) in the field, to lab-based wetting-drying treatments. It was found that while rainfall history influenced microbial respiration, those legacies of rainfall did not persist throughout their study period of four months, although soils accustomed to intense rainfall did respond less dramatically to moisture pulses. A recent experiment by Martiny et al. (2017) supports microbial decomposition is dually influenced by the contemporary environment and rainfall history. In a reciprocal transplant specifically testing the HFA, Allison et al. (2013) found that plant litter inoculated with microbes that were previously subjected to drought treatments experienced lower mass loss than expected. Taken together, these results collectively highlight the role of both historical litter and moisture inputs on microbial decomposition, and how magnitude (i.e., litter complexity; rainfall or drought intensity) ultimately dictates the persistence of the historical legacy or contingency (Hawkes and Keitt, 2015).

3.3. Travel – contrast in ecosystem properties

The inconvenience of travelling presents a major disadvantage to visiting sports teams due to the associated physical and mental fatigue and disruption of habitual routines, and accordingly, the number of time zones crossed is a travel factor consistently found to affect the HFA in sports (Goumas, 2014; Legaz-Arrese et al., 2012; Nevill and Holder, 1999). In our framework, we parallel sports team travel with contrast in ecosystem properties; as in, the degree of difference in environmental (e.g., temperature, moisture, soil properties) and ecological (e.g., plant or soil communities) conditions between the experimental sites. Travelling over space resonates with environmental space, and time zones crossed can be considered as the contrast in abiotic conditions. However, while absolute distance is not a strong predictor of HFA in sports (Pollard, 2002), similarly absolute climate is not strongly related to an ecological HFA despite being a predictor of mass loss (Veen et al., 2015b). In sports, longitudinal travel that crosses one or more time zones has a bigger role in HFA than latitudinal travel of the same distance within a time zone. For the ecological HFA, the contrast in ecosystem properties affects the HFA outcome, rather than a single variable. For instance, increasing dissimilarity between site and litter characteristics was identified as a driver of the HFA (Li et al., 2017; Veen et al., 2015a), suggesting a substrate quality-matrix quality interaction (SMI hypothesis *sensu* Freschet et al., 2012). The SMI predicts a stronger litter-site interaction and HFA potential with increasing dissimilarity of transplanted versus *in-situ* litter. Perez et al. (2013) tested and did not observe a general HFA or SMI effect, but that an HFA and SMI effect was observed when considering only the labile fractions of litter. Some of the discrepancy arising in HFA studies may be linked to the vastly different ecosystems used in experiments, as climates and soil parameters strongly interact with main drivers of decomposition to influence the HFA (Perez et al., 2013). An early study proposed the disparity in environmental conditions between ecosystems involved in the experiment (i.e., pine forest and grassland) to be a possible explanation for witnessing HFA (Hunt et al., 1988). Conversely, a more recent test of litter origin effects on decomposition rates involving disparate biomes found little evidence for microbial specificity to litter (Makkonen et al., 2012), although the HFA was not explicitly tested.

3.4. Rules - definitions

For most sports, there are certain rules that benefit the home team, such as batting last in baseball, having the last line change in ice hockey, or calling the coin toss in football. In ecology, rules can be compared to the various definitions of HFA, and how that informs what metrics are used to define it and classify an occurrence as an HFA by the researchers. Despite the abundance of HFA studies, a clear operational definition of what constitutes the HFA remains to be seen. For instance, it is unclear when to declare an observed HFA — must the effect be observed in both litter-location relationships, or only a single site? Further, some studies (e.g., Veen et al., 2015a) have also suggested possible negative (i.e., a home-field *dis*advantage) as well as positive designations for the HFA. Consistent with the original sports framework, definitional ambiguity is a barrier to general consensus around the HFA (Courneya and Carron, 1992). In ecology, the HFA is previously defined as the phenomenon where plant litter is decomposed more quickly in its home environment. However, measures of decomposition are overwhelmingly rates of mass loss, and occasionally respiration rates as CO_2 flux. What is missing is a more comprehensive index of decomposition that quantifies rates of change in detrital chemistry (i.e. nutrient stoichiometric ratios).

4. Critical psychological and behavioural states

In Courneya and Carron's (1992) process-based framework, game location factors are thought to influence the psychological and behavioural states of competitors, coaches and officials, ultimately affecting overall performance outcome (i.e., HFA). Players generally attribute successful mind sets at home to the game location factors of familiarity and crowd support as described above (Anderson et al., 2012), yet the importance of each factor varies depending on the player (McGuckin et al., 2015). For instance, coaches often have a higher expectation to win when playing at home and will employ a relatively more offensive and risky playing strategy (Staufenbiel et al., 2015). In our ecological framework, we conceptually parallel critical states of players and coaches to the functional breadth of decomposers and the 'coaching' strategy of plants, respectively.

4.1. Microbial competitors and functional breadth

In sports, the HFA has been described as an expertise deficiency; a metric for the inability to maintain performance independent of environment (Adams and Kupper, 1994). Sports research also suggests that sports inherently more aggressive and higher paced (e.g., rugby) have a greater HFA (García et al., 2013; Pollard et al., 2017). This

perception that the HFA is stronger when teams are weaker or when sports are more intense, resonates with how the ecological HFA is more commonly observed for lower quality litters, and supports the functional breadth hypothesis for microbial communities. The functional breadth hypothesis (*sensu* Keiser et al., 2014) states that an organisms' ability to decompose is a function of its historical resource and environment, and is conceptually rooted in the presence of historical contingencies (Strickland et al., 2009a) as described above. Broadly speaking, a microbial community historically exposed to a more recalcitrant litter type will have a functionally wider capacity to degrade a range of litters, versus a microbial community from a more labile environment that will display a functionally narrow decomposition capability (Keiser et al., 2014; Strickland et al., 2009b). Fanin et al. (2016) found evidence for the functional breadth hypothesis where litters were decomposed most quickly in the most recalcitrant environment, and the functional breadth hypothesis could be applied to similar results from other experiments (e.g., Chomel et al., 2015; Cleveland et al., 2014; Gergócs and Hufnagel, 2016; Milcu and Manning, 2011). Supporting this, it is thought that microbes from nutrient-rich habitats are more functionally redundant than microbes from nutrient-poor habitats (van der Heijden et al., 2008). Recently, it has been found that climate effects on decomposition are mediated by functional breadth of microbes (Keiser and Bradford, 2017).

4.2. Plant coaches and their 'coaching' strategy

Just as coaches have strategies to win competitions, plants-microbe-soil feedbacks dictate plant growth and survival (Dorrepaal et al., 2007). Exploring plant survival strategy in the context of litter decomposition can provide insight to the HFA. Within this context, strategies describing resource acquisition and use are most informative because they are reflected through foliar and litter traits (Garnier et al., 2016) that in-turn, can dictate litter quality and decomposition potential. Historically, resource acquisition has been described broadly as r-K strategists (MacArthur and Wilson, 1967) and C-S spectrum of Grime's (1977) C-S-R triangle. More recently the leaf economic spectrum (Wright et al., 2004) and fast-slow plant strategy spectrum (Reich, 2014) are now oft-used descriptors of plant resource acquisition and conservation. Similar to an 'offensive' or 'defensive' strategy coaches employ in sports, there are fast-growing, resource-acquisitive plants with flimsier, shorter-lived tissues on one end of the spectrum, contrasted by slower-growing, resource-conservative plants with denser, nutrient-poor tissues on the other. This fast-slow (*sensu* Reich, 2014) plant strategy approach helps elucidate the HFA because the concept is evident in litter-decomposition feedbacks that harmonise plant growth and decomposition with nutrient availability, ultimately contributing to a HFA. Lastly, recent attention has been paid to the role of secondary metabolites in local adaptation of microbes and the selection of specific catabolic capacities (Chomel et al., 2016), also suggesting that plants have an active role in coaching decomposition, and the HFA itself. The role of plant secondary metabolites and HFA has been considered previously (e.g., Bragazza et al., 2007) yet only addressed explicitly recently, and it is suggested that secondary metabolites contribute to local adaptation of decomposers by selecting for specific catabolic capacities (Chomel et al., 2016). Plants with high secondary metabolites link with strong HFA because there are fewer biota that are specialised to degrade the secondary metabolites, which is in line with functional breadth/lower quality litter having stronger HFA.

5. New insights

5.1. Temporal effects

In sports, the HFA has been evaluated from multiple temporal perspectives. Although studies show how a HFA can change over the course of seasons (Allen and Jones, 2014) or in a string of back-to-back games (Page and Page, 2007), the concept of time remains elusive. A meta-analysis of sports literature showed that highest and lowest HFA corresponded to both very new teams (one playing season) and very old teams (> 30 years) (Swartz and Arce, 2014). Such observations of temporal effects raise interesting questions for ecologists where decomposition follows a temporal 'ontogeny' (*sensu* Moore et al., 2004), and the strength or potential for observing an HFA may change over the process of decomposition. Ontological stage of decomposition may play a role in observing HFA outcomes when considering litters of highly contrasting quality; devising a method of standardizing decay stage (e.g., through mean residency time) may be mechanistically revealing when an overall HFA may be washed out at the larger scales of observation. The potential for HFA to vary throughout the process of decomposition (i.e., by stage) is illustrated through some anecdotal evidence (Ayres et al., 2009a; Gergócs and Hufnagel, 2016), although would benefit from explicit testing. For instance, a study testing HFA with mesofauna found that HFA was strongest (i.e., greater mass loss of home litters) at three months across all litter types (oak, pine, black locust) but then converged at 12 months (Gergócs and Hufnagel, 2016). Similarly, a triangular relationship between litter quality, stages of decomposition and the HFA emerges from evidence provided by Ayres et al. (2009a), where the HFA was measured over time for three different quality litters. The highest and lowest quality litter type exhibited greatest HFA at early and late experimental stages, respectively, while the intermediate litter quality had roughly the same HFA during both early and late stages of the experiment (Ayres et al., 2009a). This suggests that the strength of HFA throughout decomposition may be mediated by litter quality components, and is strongest where the component is most important or stoichiometrically valuable, i.e., water-soluble carbon and nutrients in the early stage for higher quality litter, and recalcitrant compounds in the late stage for low quality litter (Berg, 2000).

Under the thinking that plant-soil feedbacks grow stronger over time (Dorrepaal et al., 2007), it is likely that ability to detect a HFA may become more pronounced over multiple seasons or be affected by the successional stage of the plant community. However, relatively few studies have tested the HFA at different plant successional stages. Gießelmann et al. (2011) examined the HFA among three tropical rainforest successional stages and found no significant differences between sites, although the earliest successional stage (possessing highest quality litter) trended toward a positive HFA, while the latest successional stage (lowest quality litter) trended toward a home-field disadvantage, where decomposition was slower than expected at home. Successional stage from a microbial perspective is also an important consideration because enzyme activities can increase over time (Burns et al., 2012), and enzyme production changes alongside shifts in plant communities as litter inputs dictate stoichiometry and thus enzyme production (Mooshammer et al., 2014). In line with this, Sinsabaugh et al. (2002) found that a shift in enzyme production as a result of stoichiometric shifts (e.g., N amendment) can either enhance, inhibit or have mixed effects on decomposition depending on the litter composition. Yet microbial succession (i.e., degradative succession) involving shifts in microbial communities alongside changes in detrital ontogeny can happen over very short time intervals (Purahong et al., 2016; Voříšková and Baldrain, 2013) and can be modified by climate (Asemaninejad et al., 2017).

5.2. The HFA on a fast-slow spectrum

The pattern of a strong HFA associated 'extremes' in both sports (e.g., HFA is more strongly observed for extreme rivals or aggressive sports) and decomposition (i.e., disparate plant litter quality and or soil environments) also invokes the notion that the HFA might exist on a spectrum, and is better suited to be viewed as a continuous variable versus binary 'yes' or 'no'. Because the key components contributing to the HFA, namely plants and microbes, are increasingly viewed in terms

of having fast or slow properties promoting fast or slow decomposition and nutrient cycling, it suggests that the HFA might exist on a fast-slow spectrum as well. Although this requires further testing, evidence exists when one considers ecosystems where HFA might be most beneficial such as nutrient limited environments. For instance, peatlands and tropical rainforests occupy slow and fast ends of the nutrient-cycling spectrum, respectively, but are both nutrient-poor. While evidence for HFA has been detected in experiments involving peatlands (Bragazza et al., 2007; Palozzi and Lindo, 2017a), it has not been found in tropical rainforests (Bachega et al., 2016; Gieβelmann et al., 2011; Makkonen et al., 2012) suggesting the HFA might be a dominant strategy for 'slow' plants, microbes and ecosystems. The HFA as a strategy to overcome nutrient limitation is supported by recent evidence from Hoyos-Santillan et al. (2018) that tested the HFA in tropical peatlands. As such, ecosystems with more variable levels of nutrients (e.g., forests, prairies or grasslands) lie in the middle of the spectrum, and accordingly are the ecosystems where studies of HFA are (e.g., Ayres et al., 2009b; Hunt et al., 1988; Vivanco and Austin, 2008) or are not (e.g., Ayres et al., 2006; St. John et al., 2011) detected.

5.3. The interactive effects that facilitate a HFA: predictions and future directions

Reconciling the lack of consistency in HFA studies necessitates considering the interactive effects of plant litter quality, the contrast in abiotic environmental conditions, the functional breadth of decomposer community, including historical legacies, as well as measurements and data analysis of the researchers. It is first clear that researchers are more likely to identify the HFA when using the equations provided by Ayres et al. (2009a) because these equations take into account important litter-site differences. Studies that have used Ayres et al. equations indeed reveal that the HFA exists on a spectrum that includes null and even negative outcomes, as well as allowing standardisation and comparisons of results across different studies. The second clear trend is that the HFA is stronger when comparing disparate plant litter qualities and/or disparate soil environments, but trends are less clear when there are intermediate differences because of the interactive effects that facilitate or impede the HFA.

Prediction 1: The HFA is often more pronounced for poor quality litter because high quality litters are indiscriminately decomposed (leading to no HFA as see in Ayres et al., 2009b; Gieβelmann et al., 2011; Hunt et al., 1988). Home-field advantage experiments have revealed that more recalcitrant litter types show stronger HFA (Gergócs and Hufnagel, 2016) consistent with functional breadth hypothesis (Fanin et al., 2016; Keiser et al., 2014), while other studies have found litter quality to have no effect on HFA (Veen et al., 2015b). On the whole, many results align with the trend that decomposition of recalcitrant litter types is accelerated, while decomposition rates of more labile, rapidly decomposing litters are negatively impacted or unaffected. However, litter quality itself does not adequately explain many HFA results.

Prediction 2: Poor quality litters will benefit from nutrient rich 'away' environments and display enhanced decomposition (i.e., a negative HFA) (Hunt et al., 1988; Vivanco and Austin, 2008), whereas the decomposition of high-quality litter in a nutrient-poor environment may not be much affected due to stoichiometric considerations of the microbial community. Inherent in the concept of functional breadth and chemical complexity is stoichiometry and metabolic theory of microbial decomposition, as the goal of decomposition is to meet elemental and metabolic needs. Resource stoichiometry is an important consideration for local decomposition processes such as the HFA because of the chemical changes in plant litter during the ontogeny of detrital decay (Moore et al., 2004). Highly labile and highly recalcitrant substrates show little change in chemical composition and stoichiometric nutrient ratios over time, yet differ in overall decay rate. Most plant litters typically show a progression towards relatively greater recalcitrance over time as labile portions are utilized, yet the breakdown of complex chemical compounds from physical processes (e.g., leaching or photodegradation) may temporarily increase plant litter lability leading to differing HFA outcomes through time.

Some of the factors contribute to a HFA response, whereas others could contribute to site-specific variation in decay that could cause transplanted litter to decompose either faster or slower than its site of origin, depending on the direction of difference in the factor of interest. Therefore, making the direct connection between particular factors and their effects on HFA versus site-specific contributions that either reinforce the HFA or contribute to the variation in HFA outcome would expand our understanding of the HFA and explain the lack of consistency in HFA outcomes. Explicitly integrating all factors together is needed for conclusions regarding HFA predictions, and specifically more focus is needed in understanding of interactions between microbial communities and ideas of stoichiometry and energetics. For instance, a more general framework of energetic and stoichiometric nutrient considerations for enhancing decomposition by reducing limitations to microbial activity and growth (e.g. from root exudate carbon (Wu et al., 2011), or fungi that translocate both C and nutrients from beneath the litter layer) could elucidate HFA outcomes. Additionally, any potential negative soil conditions (e.g. conditions leading to extreme acidity, salinity or metal contamination etc.) on the overall soil food web that contribute to decomposition would also enhance our understanding of HFA outcome (Bengtsson et al., 1987; Wickings et al., 2012). However, studies testing the direct effects of fauna on HFA are scarce (but see Milcu and Manning, 2011, and Gergócs and Hufnagel, 2016), and generally show that the HFA is stronger due to the contribution of fauna when litter is recalcitrant.

6. Significance and conclusions

The home-field advantage (HFA) is a popular phenomenon in sports psychology due to its strength and consistency, while opposite reasons confer appeal in the ecological realm. The nature of decomposition dynamics is expected to change due to plant community shifts, invasive species and global change impacts. Understanding factors affecting local decomposition phenomenon such as the HFA, and having a unified approach to its interpretation, is critical for predicting and anticipating subsequent changes in decomposition affecting carbon and nutrient cycling. This paper describes a qualitative approach to elucidating the HFA phenomenon in ecology by the analogy of the sports HFA conceptual framework. We outline how the HFA is more than just 'game location' and consider game location factors (abiotic soil environment, historical contingencies, environmental contrast) and the role of behavioural and psychological states (functional breadth and plant strategy) with respect to stoichiometric and energetic requirements of both plants and microbes. Coupling quantitative analysis (e.g., equations from Ayres et al., 2009a) with the qualitative analysis of this conceptual framework, will provide ecologists a deeper understanding of HFA and litter decomposition dynamics in general. Yet, a general synthesis of ecostoichiometric nutrient considerations for enhancing decomposition by reducing limitations to microbial activity and growth, and including potential negative soil conditions (including plant–herbivore interactions, microbial symbiosis, legacies from phyllosphere communities and other attractors of specific soil fauna) on the overall soil food web when considering HFA outcomes is required.

Conflicts of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Author contributions

JEP identified the sports framework; JEP and ZL co-wrote the manuscript.

Funding

This work was supported by the Natural Sciences and Engineering Research Council of Canada, Discovery Grants Program to ZL [#418241-2012].

Acknowledgments

This manuscript has benefitted greatly from the feedback and insight of three anonymous reviewers, to which we are truly grateful. We thank A. Asemaninejad, C. Barreto, and T. Lacourse for stimulating discussions. We are grateful to all of the teammates, coaches and teams that have enriched our experience, and lastly, the anonymous source of the sidewalk-strewn cue cards of the sports HFA that provided inspiration for this paper.

References

Adams, R.D., Kupper, S.J., 1994. The effect of expertise on peak performance: the case of home-field advantage. Journal of Sport Behavior 17, 108–119.

Aerts, R., 1997. Climate, leaf litter chemistry and leaf litter decomposition in terrestrial ecosystems: a triangular relationship. Oikos 79, 439–449. http://dx.doi.org/10.2307/3546886.

Aerts, R., Chapin III, F.S., 2000. The mineral nutrition of wild plants revisited: a re-evaluation of processes and patterns. Advances in Ecological Research 30, 1–67. http://dx.doi.org/10.1016/S0065-2504(08)60016-1.

Allen, M.S., Jones, M.V., 2014. The “Home Advantage” in athletic competitions. Current Directions in Psychological Science 23, 49–53. http://dx.doi.org/10.1177/0963721413513267.

Allison, S.D., 2012. A trait-based approach for modelling microbial litter decomposition. Ecology Letters 15, 1058–1070. http://dx.doi.org/10.1111/j.1461-0248.2012.01807.x.

Allison, S.D., Martiny, J.B.H., 2008. Resistance, resilience, and redundancy in microbial communities. Proceedings of the National Academy of Sciences of the United States of America 105, 11512–11519. http://dx.doi.org/10.1073/pnas.0801925105.

Allison, S.D., Wallenstein, M.D., Bradford, M.A., 2010. Soil-carbon response to warming dependent on microbial physiology. Nature Geoscience 3, 11512–11519. http://dx.doi.org/10.1038/ngeo846.

Allison, S.D., Lu, Y., Weihe, C., Goulden, M.L., Martiny, A.D., Treseder, K.K., Martiny, J.B.H., 2013. Microbial abundance and composition influence litter decomposition response to environmental change. Ecology 94, 714–725. http://dx.doi.org/10.1890/12-1243.1.

Anderson, M., Wolfson, S., Neave, N., Moss, M., 2012. Perspectives on the home advantage: a comparison of football players, fans and referees. Psychology of Sport and Exercise 13, 311–1070. http://dx.doi.org/10.1016/j.psychsport.2011.11.012.

Asemaninejad, A., Thorn, R.G., Lindo, Z., 2017. Experimental climate change modifies degradative succession in boreal peatland fungal communities. Molecular Ecology 73, 521–531. http://dx.doi.org/10.1007/s00248-016-0875-9.

Austin, A.T., Vivanco, L., González-Arzac, A., Pérez, L.I., 2014. There's no place like home? An exploration of the mechanisms behind plant litter–decomposer affinity in terrestrial ecosystems. New Phytologist 204, 307–314. http://dx.doi.org/10.1111/nph.12959.

Ayres, E., Dromph, K.M., Bardgett, R.D., 2006. Do plant species encourage soil biota that specialise in the rapid decomposition of their litter? Soil Biology and Biochemistry 38, 183–186. http://dx.doi.org/10.1016/j.soilbio.2005.04.018.

Ayres, E., Steltzer, H., Berg, S., Wall, D.H., 2009a. Soil biota accelerate decomposition in high-elevation forests by specializing in the breakdown of litter produced by the plant species above them. Journal of Ecology 97, 901–912. http://dx.doi.org/10.1111/j.1365-2745.2009.01539.x.

Ayres, E., Steltzer, H., Simmons, B.L., Simpson, R.T., Steinweg, J.M., Wallenstein, M.D., Mellor, N., Parton, W.J., Moore, J.C., Wall, D.H., 2009b. Home-field advantage accelerates leaf litter decomposition in forests. Soil Biology and Biochemistry 41, 606–610. http://dx.doi.org/10.1016/j.soilbio.2008.12.022.

Bachega, L.R., Bouillet, J., Piccolo, M.D., Saint-André, L., Bouvet, J., Nouvellon, Y., de Moraes Gonçalves, J.L., Robin, A., Laclau, J., 2016. Decomposition of *Eucalyptus grandis* and *Acacia mangium* leaves and fine roots in tropical conditions did not meet the Home Field Advantage hypothesis. Forest Ecology and Management 359, 33–43. http://dx.doi.org/10.1016/j.foreco.2015.09.026.

Bahn, M., Reichstein, M., Davidson, E.A., Grünzweig, J., Jung, M., Carbone, M.S., Epron, D., Misson, L., Nouvellon, Y., Roupsard, O., Savage, K., Trumbore, S.E., Gimeno, C., Yuste, J.C., Tang, J., Vargas, R., Janssens, I.A., 2010. Soil respiration at mean annual temperature predicts annual total across vegetation types and biomes. Biogeosciences 7, 2147–2157. http://dx.doi.org/10.5194/bg-7-2147-2010.

Balmer, N.J., Nevill, A.M., Williams, A.M., 2003. Modelling home advantage in the summer olympic games. Journal of Sports Sciences 21, 469–478. http://dx.doi.org/10.1080/0264041031000101890.

Bardgett, R.D., Manning, P., Morriën, E., de Vries, F.T., 2013. Hierarchical responses of plant–soil interactions to climate change: consequences for the global carbon cycle. Journal of Ecology 101, 334–343. http://dx.doi.org/10.1111/1365-2745.12043.

Baxendale, C., Orwin, K., Poly, F., Pommier, T., Bardgett, R.D., 2014. Are plant–soil feedback responses explained by plant traits? New Phytologist 204, 408–423. http://dx.doi.org/10.1111/nph.12915.

Bengtsson, G., Berden, M., Rundgren, S., 1987. Influence of soil animals and metals on decomposition processes: a microcosm experiment. Journal of Environmental Quality 17, 113–119.

Berg, B., 2000. Litter decomposition and organic matter turnover in northern forest soils. Forest Ecology and Management 133, 13–22. http://dx.doi.org/10.1016/S0378-1127(99)00294-7.

Berg, B., McClaugherty, C., 2014. Plant Litter: Decomposition, Humus Formation and Carbon Sequestration, third ed. Springer, Heidelberg.

Boyko, R.H., Boyko, A.R., Boyko, M.G., 2007. Referee bias contributes to home advantage in English Premiership football. Journal of Sports Sciences 25, 1185–1194. http://dx.doi.org/10.1080/02640410601038576.

Boynton, P.J., Stelkens, R., Kowallik, V., Greig, D., 2017. Measuring microbial fitness in a field reciprocal transplant experiment. Molecular Ecology Resources 17, 370–380. http://dx.doi.org/10.1111/1755-0998.12562.

Bradford, M.A., 2013. Thermal adaptation of decomposer communities in warming soils. Frontiers in Microbiology 4, 33. http://dx.doi.org/10.3389/fmicb.2013.00333.

Bradford, M.A., Berg, B., Maynard, D.S., Wieder, W.R., Wood, S.A., 2016. Understanding the dominant controls on litter decomposition. Journal of Ecology 104, 229–238. http://dx.doi.org/10.1111/1365-2745.12507.

Bragazza, L., Siffi, C., Iacumin, P., Gerdol, R., 2007. Mass loss and nutrient release during litter decay in peatland: the role of microbial adaptability to litter chemistry. Soil Biology and Biochemistry 39, 257–267. http://dx.doi.org/10.1016/j.soilbio.2006.07.014.

Burns, R.G., DeForest, J.L., Marxsen, J., Sinabaugh, R.L., Stromberger, M.E., Wallenstein, M.D., Weintraub, M.N., Zoppini, A., 2012. Soil enzymes in a changing environment: current knowledge and future directions. Soil Biology and Biochemistry 58, 216–234. http://doi.org/10.1016/j.soilbio.2012.11.009.

Cahill, J.F., Cale, J.A., Karst, J., Bao, T., Pec, G.J., Erbilgin, N., 2017. No silver bullet: different soil handling techniques are useful for different research questions, exhibit differential type I and II error rates, and are sensitive to sampling intensity. New Phytologist 216, 11–14. http://dx.doi.org/10.1111/nph.14141.

Carrillo, Y., Ball, B.A., Molina, M., 2016. Stoichiometric linkages between plant litter, trophic interactions and nitrogen mineralization across the litter-soil interface. Soil Biology and Biochemistry 92, 102–110. http://dx.doi.org/10.1016/j.soilbio.2015.10.001.

Carron, A.V., Loughhead, T.M., Bray, S.R., 2005. The home advantage in sport competitions: Courneya and Carron's (1992) conceptual framework a decade later. Journal of Sports Sciences 23, 395–407. http://dx.doi.org/10.1080/02640410400021542.

Chomel, M., Guittonny-Larchevêque, M., DesRochers, A., Baldy, V., 2015. Home field advantage of litter decomposition in pure and mixed plantations under boreal climate. Ecosystems 18, 1014–1028. http://dx.doi.org/10.1007/s10021-015-9880-y.

Chomel, M., Guittonny-Larchevêque, M., Fernandez, C., Gallet, C., DesRochers, A., Paré, D., Jackson, B.G., Baldy, V., 2016. Plant secondary metabolites: a key driver of litter decomposition and soil nutrient cycling. Journal of Ecology 104http://dx.doi.org/10.1111/1365-2745.12644. 1527–1028.

Clarke, S.R., Norman, J.M., 1995. Home ground advantage of individual clubs in English soccer. Statistician 44, 509–521. http://dx.doi.org/10.2307/2348899.

Classen, A.T., Sundqvist, M.K., Henning, J.A., Newman, G.S., Moore, J.A.M., Cregger, M.A., Moorhead, L.C., Patterson, C.M., 2015. Direct and indirect effects of climate change on soil microbial and soil microbial-plant interactions: what lies ahead? Ecosphere 104http://dx.doi.org/10.1890/ES15-00217.1. 1527–1028.

Cleveland, C.C., Reed, S.C., Keller, A.B., Nemergut, D.R., O'Neill, S.P., Ostertag, R., Vitousek, P.M., 2014. Litter quality versus soil microbial community controls over decomposition: a quantitative analysis. Oecologia 174, 283–294. http://dx.doi.org/10.1007/s00442-013-2758-9.

Coleman, D.C., Reid, C.P.P., Cole, C.V., 1983. Biological strategies of nutrient cycling in soil systems. Advances in Ecological Research 13, 1–55. http://dx.doi.org/10.1016/S0065-2504(08)60107-5.

Cornelissen, J.H.C., Pérez-Harguindeguy, N., Díaz, S., Grime, P.J., Marzano, B., Cabido, M., Vendramini, F., Cerabolini, B., 1999. Leaf structure and defence control litter decomposition rate across species and life forms in regional floras on two continents. New Phytologist 143, 191–200. http://dx.doi.org/10.1046/j.1469-8137.1999.00430.x.

Cornwell, W.K., Cornelissen, J.H.C., Amatangelo, K., Dorrepaal, E., Eviner, V.T., Godoy, O., Hobbie, S.E., Hoorens, B., Kurokawa, H., Pérez-Harguindeguy, N., Quested, H.M., Santiago, L.S., Wardle, D.A., Wright, I.J., Aerts, R., Allison, S.D., Van Bodegom, P., Brovkin, V., Chatain, A., Callaghan, T.V., Díaz, S., Garnier, E., Gurvich, D.E., Kazakou, E., Klein, J.A., Read, J., Reich, P.B., Soudzilovskaia, N.A., Vaieretti, M.V., Westoby, M., 2008. Plant species traits are the predominant control on litter decomposition rates within biomes worldwide. Ecology Letters 11, 1065–1071. http://dx.doi.org/10.1111/j.1461-0248.2008.01219.x.

Courneya, K.S., Carron, A.V., 1992. The home advantage in sports competitions: a literature review. Journal of Sport & Exercise Psychology 14, 13–27. http://dx.doi.org/10.1123/jsep.14.1.13.

Coûteaux, M., Bottner, P., Berg, B., 1995. Litter decomposition, climate and litter quality. Trends in Ecology & Evolution 10, 1065–1071. http://dx.doi.org/10.1016/S0169-5347(00)88978-8.

de Vries, F.T., Manning, P., Tallowin, J.R.B., Mortimer, S.R., Pilgrim, E.S., Harrison, K.A.,

Hobbs, P.J., Quirk, H., Shipley, B., Cornelissen, J.H.C., Kattge, J., Bardgett, R.D., 2012. Abiotic drivers and plant traits explain landscape-scale patterns in soil microbial communities. Ecology Letters 15, 1230–1239. http://dx.doi.org/10.1111/j.1461-0248.2012.01844.x.

Del Giudice, R., Lindo, Z., 2017. Short-term leaching dynamics of three peatland plant species reveals how shifts in plant communities may affect decomposition processes. Geoderma 285, 110–116. http://dx.doi.org/10.1016/j.geoderma.2016.09.028.

Dorrepaal, E., Cornelissen, J.H.C., Aerts, R., 2007. Changing leaf litter feedbacks on plant production across contrasting sub-arctic peatland species and growth forms. Oecologia 151, 251–261. http://dx.doi.org/10.1007/s00442-006-0580-3.

Evans, S.E., Wallenstein, M.D., 2012. Soil microbial community response to drying and rewetting stress: does historical precipitation regime matter? Biogeochemistry 109, 101–116. http://dx.doi.org/10.1007/s10533-011-9638-3.

Fanin, N., Bertrand, I., 2016. Aboveground litter quality is a better predictor than belowground microbial communities when estimating carbon mineralization along a land-use gradient. Soil Biology and Biochemistry 94, 48–60. http://dx.doi.org/10.1016/j.soilbio.2015.11.007.

Fanin, N., Fromin, N., Bertrand, I., 2016. Functional breadth and home-field advantage generate functional differences among soil microbial decomposers. Ecology 97, 1023–1037. http://dx.doi.org/10.1016/j.soilbio.2015.11.007.

Freschet, G.T., Aerts, R., Cornelissen, J.H.C., 2012. Multiple mechanisms for trait effects on litter decomposition: moving beyond home-field advantage with a new hypothesis. Journal of Ecology 100, 619–630. http://dx.doi.org/10.1111/j.1365-2745.2011.01943.x.

Frey, S., Lee, J., Melillo, J.M., Six, J., 2013. The temperature response of soil microbial efficiency and its feedback to climate. Nature Climate Change 3, 395–398. http://dx.doi.org/10.1038/nclimate1796.

García, M.S., Aguilar, O.G., Marques, P.S., Tobío, G.T., Romero, J.J.F., 2013. Calculating home advantage in the first decade of the 21st century UEFA soccer leagues. Journal of Human Kinetics 38, 141–150. http://dx.doi.org/10.2478/hukin-2013-0054.

García-Palacios, P., McKie, B.G., Handa, I.T., Frainer, A., Hättenschwiler, S., 2015. The importance of litter traits and decomposers for litter decomposition: a comparison of aquatic and terrestrial ecosystems within and across biomes. Functional Ecology 30, 819–829. http://dx.doi.org/10.1111/1365-2435.12589.

García-Palacios, P., Shaw, E.A., Wall, D.H., Hättenschwiler, S., 2016. Temporal dynamics of biotic and abiotic drivers of litter decomposition. Ecology Letters 19, 554–563. http://dx.doi.org/10.1111/ele.12590.

Garnier, E., Navas, M.L., Grigulis, K., 2016. Plant Functional Diversity: Organism Traits, Community Structure and Ecosystem Properties. Oxford University Press, Oxford.

Gayton, W.F., Broidea, J., Elgee, L., 2001. An investigation of coaches' perceptions of the causes of the home advantage. Perceptual & Motor Skills 92, 933–936. http://dx.doi.org/10.2466/pms.2001.92.3.933.

Geisen, S., 2016. The bacterial-fungal energy channel concept challenged by enormous functional versatility of soil protists. Soil Biology and Biochemistry 102, 22–25. http://dx.doi.org/10.1016/j.soilbio.2016.06.013.

Gergócs, V., Hufnagel, L., 2016. The effect of microarthropods on litter decomposition depends on litter quality. European Journal of Soil Biology 75, 24–30. http://dx.doi.org/10.1016/j.ejsobi.2016.04.008.

Gholz, H., Wedin, D.A., Smitherman, S.M., Harmon, M.E., Parton, W.J., 2000. Long-term dynamics of pine and hardwood litter in contrasting environments: toward a global model of decomposition. Global Change Biology 6, 751–765. http://dx.doi.org/10.1046/j.1365-2486.2000.00349.x.

Gießelmann, U.C., Martins, K.G., Brändle, M., Schädler, M., Marques, R., Brandl, R., 2011. Lack of home-field advantage in the decomposition of leaf litter in the Atlantic Rainforest of Brazil. Applied Soil Ecology 49, 5–10. http://dx.doi.org/10.1016/j.apsoil.2011.07.010.

Gorter, F.A., Scanlan, P.D., Buckling, A., 2016. Adaptation to abiotic conditions drives local adaptation in bacteria and viruses coevolving in heterogeneous environments. Biology Letters 12, 20150879. http://dx.doi.org/10.1098/rsbl.2015.0879.

Goumas, C., 2014. Home advantage in Australian soccer. Journal of Science and Medicine in Sport 17, 119–123. http://dx.doi.org/10.1016/j.jsams.2013.02.014.

Grime, J.P., 1977. Evidence for the existence of three primary strategies in plants and its relevance to ecological and evolutionary theory. The American Naturalist 111, 1169–1194. http://dx.doi.org/10.1086/283244.

Gui, H., Purahong, W., Hyde, K.D., Xu, J., Mortimer, P.E., 2017. The arbuscular mycorrhizal fungus *Funneliformis mosseae* alters bacterial communities in subtropical forest soils during litter decomposition. Frontiers in Microbiology 8, 1120. http://dx.doi.org/10.3389/fmicb.2017.01120.

Gundale, M.J., Wardle, D.A., Kardol, P., van der Putten, W., Lucas, R.W., 2017. Soil handling methods should be selected based on research questions and goals. New Phytologist 216, 18–23. http://dx.doi.org/10.1111/nph.14659.

Hättenschwiler, S., Tiunov, A.V., Scheu, S., 2005. Biodiversity and litter decomposition in terrestrial ecosystems. Annual Reviews in Ecology, Evolution and Systematics 36, 191–218. http://dx.doi.org/10.1146/annurev.ecolsys.36.112904.151932.

Hawkes, C.V., Keitt, T.H., 2015. Resilience vs. historical contingency in microbial responses to environmental change. Ecology Letters 18, 612–625. http://dx.doi.org/10.1111/ele.12451.

Haynes, K.M., Preston, M.D., McLaughlin, J.W., Webster, K., Basiliko, N., 2015. Dissimilar bacterial and fungal decomposer communities across rich to poor fen peatlands exhibit functional redundancy. Canadian Journal of Soil Science 95, 219–230. http://dx.doi.org/10.4141/CJSS-2014-062.

Hoyos-Santillan, J., Lomax, B.H., Turner, B.L., Sjögersten, S., 2018. Nutrient limitation or home field advantage: does microbial community adaptation overcome nutrient limitation of litter decomposition in a tropical peatland? Journal of Ecology 1–12. http://dx.doi.org/10.1111/1365-2745.12923.

Hunt, H.W., Coleman, D.C., Ingham, E.R., Ingham, R.E., Elliot, E.T., Moore, J.C., Reed, C.P.P., Morley, C.R., 1987. The detrital food web in a shortgrass prairie. Biology and Fertility of Soils 3, 57–68. http://dx.doi.org/10.1007/BF00260580.

Hunt, H.W., Ingham, E.R., Coleman, D.C., Elliott, E.T., Reid, C.P.P., 1988. Nitrogen limitation of production and decomposition in prairie mountain meadow and pine forest. Ecology 69, 1009–1016. http://dx.doi.org/10.2307/1941256.

Jacob, M., Viedenz, K., Polle, A., Thomas, F.M., 2010. Leaf litter decomposition in temperate deciduous forest stands with a decreasing fraction of beech (*Fagus sylvatica*). Oecologia 164, 1083–1094. http://dx.doi.org/10.1007/s00442-010-1699-9.

Jewell, M.D., Shipley, B., Paquette, A., Messier, C., Reich, P.B., 2015. A traits-based test of the home-field advantage in mixed-species tree litter decomposition. Annals of Botany 116, 781–788. http://dx.doi.org/10.1093/aob/mcv105xs.

Jiang, X., Cao, L., Zhang, R., Yan, L., Mao, Y., Yang, Y., 2014. Effects of nitrogen addition and litter properties on litter decomposition and enzyme activities of individual fungi. Applied Soil Ecology 80, 108–115. http://dx.doi.org/10.1016/j.apsoil.2014.04.002.

Joly, F., Milcu, A., Scherer-Lorenzen, M., Jean, L., Bussotti, F., Dawud, S.M., Müller, S., Pollastrini, M., Raulund-Rasmussen, K., Vesterdal, L., Hättenschwiler, S., 2017. Tree species diversity affects decomposition through modified micro-environmental conditions across European forests. New Phytologist 214, 1281–1293. http://dx.doi.org/10.1111/nph.14452.

Keiser, A.D., Bradford, M.A., 2017. Climate masks decomposer influence in a cross-site litter decomposition study. Soil Biology and Biochemistry 107, 180–187. http://dx.doi.org/10.1016/j.soilbio.2016.12.022.

Keiser, A.D., Keiser, D.A., Strickland, M.S., Bradford, M.A., 2014. Disentangling the mechanisms underlying functional differences among decomposer communities. Journal of Ecology 102, 603–609. http://dx.doi.org/10.1111/1365-2745.12220.

Keiser, A.D., Strickland, M.S., Fierer, N., Bradford, M.A., 2011. The effect of resource history on the functioning of soil microbial communities is maintained across time. Biogeosciences 8, 1477–1486. http://dx.doi.org/10.5194/bg-8-1477-2011.

Legaz-Arrese, A., Moliner-Urdiales, D., Munguía-Izquierdo, D., 2012. Home advantage and sports performance: evidence, causes and psychological implications. Universitas Psychologica 12, 933–943. http://dx.doi.org/10.11144/Javeriana.UPSY12-3.hasp.

Li, Y.-B., Li, Q., Yang, J., Lü, X., Liang, W., Han, X., Bezemer, M.T., 2017. Home-field advantages of litter decomposition increase with increasing N deposition rates: a litter and soil perspective. Functional Ecology 31, 1792–1801. http://dx.doi.org/10.1111/1365-2435.12863.

Lu, W., Liu, N., Zhang, Y., Zhou, J., Guo, Y., Yang, X., 2017. Impact of vegetation community on litter decomposition: evidence from a reciprocal transplant study with ^{13}C labeled plant litter. Soil Biology and Biochemistry 112, 248–257. http://dx.doi.org/10.1016/j.soilbio.2017.05.014.

MacArthur, R.H., Wilson, E.O., 1967. The Theory of Island Biogeography. Princeton University Press, New Jersey.

Makkonen, M., Berg, M.P., Handa, T., Hättenschwiler, S., van Ruijven, J., van Bodegom, P.M., Aerts, R., 2012. Highly consistent effects of plant litter identity and functional traits on decomposition across a latitudinal gradient. Ecology Letters 15, 1033–1041. http://dx.doi.org/10.1111/j.1461-0248.2012.01826.x.

Martiny, J.B.H., Martiny, A.C., Weihe, C., Lu, Y., Berlemont, R., Brodie, E.L., Goulden, M.L., Treseder, K.T., Allison, S.D., 2017. Microbial legacies alter decomposition in response to simulated global change. The ISME Journal 11, 490–499. http://dx.doi.org/10.1038/ismej.2016.122.

McGuckin, T.A., Sinclair, W.H., Sealey, R.M., Bowman, P.W., 2015. Players' perceptions of home advantage in the Australian rugby league competition. Perceptual & Motor Skills 121, 666–674. http://dx.doi.org/10.2466/06.PMS.121c28x4.

Midgley, M.G., Brzostek, E., Phillips, R.P., 2015. Decay rates of leaf litters from arbuscular mycorrhizal trees are more sensitive to soil effects than litters from ectomycorrhizal trees. Journal of Ecology 103, 1254–1463. http://dx.doi.org/10.1111/1365-2745.12467.

Milcu, A., Manning, P., 2011. All size classes of soil fauna and litter quality control the acceleration of litter decay in its home environment. Oikos 20, 1366–1370. http://dx.doi.org/10.1111/j.1600-0706.2010.19418.x.

Moore, J.C., Berlow, E.L., Coleman, D.C., de Ruiter, P.C., Dong, Q., Hastings, A., Collins Johnson, N., McCann, K.S., Melville, K., Morin, P.J., Nadelhoffer, K., Rosemond, A.D., Post, D.M., Sabo, J.L., Scow, K.M., Vanni, M.J., Wall, D.H., 2004. Detritus, trophic dynamics and biodiversity. Ecology Letters 7, 584–600. http://dx.doi.org/10.1111/j.1461-0248.2004.00606.x.

Mooshammer, M., Wanek, W., Zechmeister-Boltenstern, S., Richter, A., 2014. Stoichiometric imbalances between terrestrial decomposer communities and their resources: mechanisms and implications of microbial adaptations to their resources. Frontiers in Microbiology 5, 22. http://dx.doi.org/10.3389/fmicb.2014.00022.

Nevill, A.M., Holder, R.L., 1999. Home advantage in sport: an overview of studies on the advantage of playing at home. Sports Medicine 28, 221–236.

Orwin, K.H., Buckland, S.M., Johnson, D., Turner, B.L., Smart, S., Oakley, S., Bardgett, R.D., 2010. Linkages of plant traits to soil properties and the functioning of temperate grassland. Journal of Ecology 98, 1074–1083. http://dx.doi.org/10.1111/j.1365-2745.2010.01679.x.

Page, L., Page, K., 2007. The second leg home advantage: evidence from European football cup competitions. Journal of Sports Sciences 25, 1547–1556. http://dx.doi.org/10.1080/02640410701275219.

Palozzi, J.E., Lindo, Z., 2017a. Pure and mixed litters of *Sphagnum* and *Carex* exhibit a home-field advantage in Boreal peatlands. Soil Biology and Biochemistry 115, 161–168. http://dx.doi.org/10.1016/j.soilbio.2017.08.026.

Palozzi, J.E., Lindo, Z., 2017b. Boreal peat properties link to plant functional traits of ecosystem engineers. Plant and Soil 418, 277–299. http://dx.doi.org/10.1007/s11104-017-3291-0.

Pearse, I.S., Cobb, R.C., Karban, R., 2014. The phenology–substrate-match hypothesis explains decomposition rates of evergreen and deciduous oak leaves. Journal of

Ecology 102, 28–35. http://dx.doi.org/10.1111/1365-2745.12182.
Perez, G., Aubert, M., Decaëns, T., Trap, J., Chauvat, M., 2013. Home-field advantage: a matter of interaction between litter biochemistry and decomposer biota. Soil Biology and Biochemistry 67, 245–254. http://dx.doi.org/10.1016/j.soilbio.2013.09.004.
Pérez-Harguindeguy, N., Díaz, S., Cornelissen, J.H.C., Vendramini, F., Cabido, M., Castellanos, A., 2000. Chemistry and toughness predict leaf litter decomposition rates over a wide spectrum of functional types and taxa in central Argentina. Plant and Soil 218, 21–30. http://dx.doi.org/10.1023/A:1014981715532.
Pollard, R., 2002. Evidence of a reduced home advantage when a team moves to a new stadium. Journal of Sports Sciences 20, 969–973. http://dx.doi.org/10.1080/026404102321011724.
Pollard, R., Preito, J., Gómez, M., 2017. Global differences in home advantage by country, sport and sex. International Journal of Performance Analysis in Sport 17, 586–599. http://dx.doi.org/10.1080/24748668.2017.1372164.
Purahong, W., Wubet, T., Lentendu, G., Schloter, M., Pecyna, M.J., Kapturska, D., Hofrichter, M., Krüger, D., Buscot, F., 2016. Life in leaf litter: novel insights into community dynamics of bacteria and fungi during litter decomposition. Molecular Ecology 25, 4059–4074. http://dx.doi.org/10.1111/mec.13739.
Reich, P.B., 2014. The world-wide 'fast–slow' plant economics spectrum: a traits manifesto. Journal of Ecology 102, 275–301. http://dx.doi.org/10.1111/1365-2745.12211.
Reinhart, K.O., Rinella, M.J., 2016. A common soil handling technique can generate incorrect estimates of soil biota effects on plants. New Phytologist 210, 786–789. http://dx.doi.org/10.1111/nph.13822.
Rinella, M.J., Reinhart, K.O., 2017. Mixing soil samples across experimental units ignores uncertainty and generates incorrect estimates of soil biota effects on plants. New Phytologist 216, 15–17. http://dx.doi.org/10.1111/nph.14432.
Roth, A., 1957. You have to win on the road. Sport 24, 74.
Rousk, J., Brookes, P.C., Glanville, H.C., Jones, D.L., 2011. Lack of correlation between turnover of low-molecular-weight dissolved organic carbon and differences in microbial community composition or growth across a soil pH gradient. Applied and Environmental Microbiology 77, 2791–2795. http://dx.doi.org/10.1128/AEM.02870-10.
Rubin, E., 1958. The edge of familiarity. The American Statistician 12, 28–29. http://dx.doi.org/10.2307/2682674.
Sauvadet, M., Chauvat, M., Brunet, N., Bertrand, I., 2017. Can changes in litter quality drive soil fauna structure and functions? Soil Biology and Biochemistry 107, 94–103. http://dx.doi.org/10.1016/j.soilbio.2016.12.018.
Sayer, E.J., Oliver, A.E., Fridley, J.D., Askew, A.P., Mills, R.T.E., Grime, J.P., 2017. Links between soil microbial communities and plant traits in a species-rich grassland under long-term climate change. Ecology and Evolution 7, 855–862. http://dx.doi.org/10.1002/ece3.2700.
Schimel, J.P., Schaeffer, S.M., 2012. Microbial control over carbon cycling in soil. Frontiers in Microbiology 3, 348. http://dx.doi.org/10.3389/fmicb.2012.00348.
Schwartz, B., Barsky, S.F., 1977. The home advantage. Social Forces 55, 641–661. http://dx.doi.org/10.2307/2577461.
Sinsabaugh, R.L., Carreiro, C.C., Repert, D.A., 2002. Allocation of extracellular enzymatic activity in relation to litter composition, N deposition, and mass loss. Biogeochemistry 60, 1–24. http://dx.doi.org/10.1023/A:1016541114786.
St John, M.G., Orwin, K.H., Dickie, I.A., 2011. No 'home' versus 'away' effects of decomposition found in a grassland-forest reciprocal litter transplant study. Soil Biology and Biochemistry 43, 1482–1489. http://dx.doi.org/10.1016/j.soilbio.2011.03.022.
Staufenbiel, K., Lobinger, B., Strauss, B., 2015. Home advantage in soccer—a matter of expectations, goal setting and tactical decisions of coaches? Journal of Sports Sciences 33, 1932–1941. http://dx.doi.org/10.1080/02640414.2015.1018929.
Strickland, M.S., Keiser, A.D., Bradford, M.A., 2015. Climate history shapes contemporary leaf litter decomposition. Biogeochemistry 122, 165–174. http://dx.doi.org/10.1007/s10533-014-0065-0.
Strickland, M.S., Lauber, C., Fierer, N., Bradford, M.A., 2009a. Testing the functional significance of microbial community composition. Ecology 90, 441–451. http://dx.doi.org/10.1890/08-0296.1.
Strickland, M.S., Osburn, E., Lauber, C., Fierer, N., Bradford, M.A., 2009b. Litter quality is in the eye of the beholder: initial decomposition rates as a function of inoculum characteristics. Functional Ecology 23, 627–636. http://dx.doi.org/10.1111/j.1365-2435.2008.01515.x.
Swartz, T.B., Arce, A., 2014. New insights involving the home advantage. International Journal of Sports Science & Coaching 9, 681–692. http://dx.doi.org/10.1260/1747-9541.9.4.681.
van der Heijden, M.G.A., Bardgett, R.D., van Straalen, N.M., 2008. The unseen majority: soil microbes as drivers of plant diversity and productivity in terrestrial ecosystems. Ecology Letters 11, 296–310. http://dx.doi.org/10.1111/j.1461-0248.2007.01139.x.
Veen, G.F., Freschet, G.T., Ordonez, A., Wardle, D.A., 2015a. Litter quality and environmental controls of home-field advantage effects on litter decomposition. Oikos 124, 187–195. http://dx.doi.org/10.1111/oik.01374.
Veen, G.F., Sundqvist, M.K., Wardle, D.A., 2015b. Environmental factors and traits that drive plant litter decomposition do not determine home-field advantage effects. Functional Ecology 29, 981–991. http://dx.doi.org/10.1111/1365-2435.12421.
Vivanco, L., Austin, A.T., 2008. Tree species identity alters forest litter decomposition through long-term plant and soil interactions in Patagonia, Argentina. Journal of Ecology 96, 727–736. http://dx.doi.org/10.1111/j.1365-2745.2008.01393.x.
Voříšková, J., Baldrain, P., 2013. Fungal community on decomposing leaf litter undergoes rapid successional changes. The ISME Journal 7, 477–486. http://dx.doi.org/10.1038/ismej.2012.116.
Wallenstein, M.D., McNulty, S., Fernandez, I.J., Boggs, J., Schlesinger, W.H., 2006. Nitrogen fertilization decreases forest soil fungal and bacterial biomass in three long-term experiments. Forest Ecology and Management 222, 459–468. http://dx.doi.org/10.1016/j.foreco.2005.11.002.
Wang, J., You, Y., Tang, Z., Lui, S., Sun, O.J., 2014. Variations in leaf litter decomposition across contrasting forest stands and controlling factors at local scales. Journal of Plant Ecology 8, 261–272. http://dx.doi.org/10.1093/jpe/rtu019.
Waring, B.G., Averill, C., Hawkes, C.V., 2013. Differences in fungal and bacterial physiology alter soil carbon and nitrogen cycling: insights from meta-analysis and theoretical models. Ecology Letters 16, 887–894. http://dx.doi.org/10.1111/ele.12125.
Wickings, K., Grandy, A.S., Reed, S.C., Cleveland, C.C., 2012. The origin of litter chemical complexity during decomposition. Ecology Letters 15, 1180–1188. http://dx.doi.org/10.1111/j.1461-0248.2012.01837.x.
Wright, I.J., Reich, P.B., Westoby, M., Ackerly, D.D., Baruch, Z., Bongers, F., Cavender-Bares, J., Chapin, T., Cornelissen, J.H.C., Diemer, M., Flexas, J., Garnier, E., Groom, P.K., Gulias, J., Hikosaka, K., Lamont, B.B., Lee, T., Lee, W., Lusk, C., Midgeley, J.J., Navas, M., Niinemets, Ü., Oleksyn, J., Osada, N., Poorter, H., Poot, P., Prior, L., Pyankov, V.I., Roumet, C., Thomas, S.C., Tjoelker, M.G., Veneklaas, E.J., Villar, R., 2004. The worldwide leaf economics spectrum. Nature 428, 821–827. http://dx.doi.org/10.1038/nature02403.
Wu, J., Liu, Z., Wang, X., Sun, Y., Zhou, L., Lin, Y., Fu, S., 2011. Effects of understory removal and tree girdling on soil microbial community composition and litter decomposition in two Eucalyptus plantations in South China. Functional Ecology 25, 921–931.
Yu, Z., Huang, Z., Wang, M., Liu, R., Zheng, L., Wan, X., Hu, Z., Davis, M.R., Lin, T., 2015. Nitrogen addition enhances home-field advantage during litter decomposition in subtropical forest plantations. Soil Biology and Biochemistry 90, 188–196. http://dx.doi.org/10.1016/j.soilbio.2015.07.026.
Zhang, D., Hui, D., Luo, Y., Zhou, G., 2008. Rates of litter decomposition in terrestrial ecosystems: global patterns and controlling factors. Journal of Plant Ecology 1, 85–93. http://dx.doi.org/10.1093/jpe/rtn002.